Classifying Triangles

Brief Overview:

In this unit the students will learn how to classify triangles based on angle measurement and side length. The students are expected to have prior knowledge of angle types (obtuse, acute, and right) and measuring angles with a protractor before beginning this unit. The students will be taking a discovery/hands-on approach to reach the objectives of the lessons. Technology is incorporated into two of the three lessons. Informal and formal assessments are included, with a summative assessment after lesson three.

NCTM Content Standard/National Science Education Standard:

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

- Identify, compare, and analyze attribute of two- and three-dimensional shapes and develop vocabulary to describe the attribute;
- Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids.

Grade/Level:

Grades 4 – 5

Duration/Length:

50 – 60 minutes; 3 days

Student Outcomes:

Students will:

- classify triangles by their angle measurements; acute, obtuse, and right
- create right triangles, acute triangles, and obtuse triangles using geoboards/geodot paper
- classify triangles by their side lengths; equilateral, isosceles, and scalene
- create equilateral triangles, isosceles triangles, and scalene triangles using Anglegs/flexible straws
- be able to calculate the sum of the angles of a triangle
- utilize a computer program to add angle measurements

Materials and Resources:

Day 1:

- Student Resources 1 - 3
- Teacher Resources 1 - 4
- Scissors

- Geoboards or geodot paper
- Rubber bands
- The Greedy Triangle by Marilyn Burns
- Pencils
- Poster board
- Sentence strips
- 3 Posters of 3 boats (see Teacher Resource 3)
- Tape
- Pretzel sticks (9 per student)

Day 2:

- Student Resources 4 - 6
- Teacher Resources 5 - 7
- Computers with internet access
- Anglegs (*Classroom Products* P.O. Box 26 Bloomingdale, IL 60108) or flexible straws (4 different colors; 15 of each color per student)
- Chart paper
- Geodot paper
- Pencils
- Ruler
- Lined notebook paper
- Toothpicks or popsicle sticks

Day 3:

- Student Resources 7 – 8
- Teacher Resources 8 – 12
- Computers with internet access
- Protractors
- Pencils
- Pretzel sticks
- Calculator
- Overhead and transparencies or document camera

Development/Procedures:

Lesson 1

Pre-Assessment

Begin a discussion based on these two statements: "All triangles have…." and "Some triangles have…" The teacher will give examples, if needed. (All triangles have three sides. / Some triangles have two sides of equal length.") Encourage student responses (See Teacher Resource #1a - b).

Launch

Read the book, The Greedy Triangle, by Marilyn Burns.

Teacher Facilitation/Student Application

- Model how to make different triangles using the geoboards/dot paper.
- The students will create triangles using geoboards with verbal teacher prompts included (Teacher Resource 2).
- The students will record the triangles on geodot paper as they create them (Student resource 1).
- Ask the students to discuss what they noticed while making the triangles. Begin the discussion with the question:
  - "What did you notice about the angles of the triangles?" (e.g. Some triangles have a right angle, some triangles have very small angles and some triangles have large angles).
- The students will cut out the triangles from their geodot paper.
- There will be three boat samples taped to the board, each representing a different angle type (See Teacher Resource 3).
- Place an obtuse triangle under the large (obtuse) boat, an acute triangle under "a cute" little boat (acute), and a right triangle under the sailboat (right).
- The students will be asked to place a triangle under the boat where he/she thinks it belongs.
- Verify if the placement is correct or not. All students will have a chance to place their triangles under the correct boat.
- Ask the students what all of the angles have in common.
- The students will develop definitions for right triangle, acute triangle, and obtuse triangles by looking at the examples on the board.
- Write the definitions on a sentence strip and tape it to each boat.
- Point out that the order of the boats on the board stand for O.A.R. (O= obtuse, A= acute, and R= right).
- The students will write the vocabulary in their math notebooks.

Embedded Assessment

The student will complete an exit ticket using this skill. (See Teacher Resource 4a – b).

Reteaching/Extension

- The lesson will be modified to meet the needs of the special education students by having the vocabulary words pre-typed (See Student Resource 2).
- The teacher will re-teach the concept to those students who were unable to correctly answer the questions on the exit ticket the day before. Use pretzel sticks to revisit the concept by asking the students to create a specific angle first and then create the triangle. (e.g. create a right angle, then turn the right angle into a right triangle)
- Extend the lesson for students who easily understood the concept. Challenge students to change triangles on their geoboards to other polygons (See Student Resource 3).

Lesson 2

Pre-Assessment

Introduce "If…., then….." statements relating to triangles. For example, "If a figure is a triangle, then it has three sides." The special education students have a word bank for this activity (See Teacher Resource #5a – c).

Launch

- Using the website (National Library of Virtual Manipulatives – 3-5 Grade Geometry – Geoboards) the teacher will model making different types of triangles. http://nlvm.usu.edu/en/nav/frames_asid_172_g_2_t_3.html?open=activities&from=topic_t_3.html
- The students will discuss what they noticed about these different triangles (e.g. different side lengths). The teacher will lead the discussion with the questions:
  - "What did you notice about the length of the sides?", "Do they all have the same length?"

Teacher Facilitation/Student Application

- Model making different types of triangles using Anglegs or flexible straws (See Teacher Resource 6a - b).
- Show the students how to join the anglegs or flexistraws.
- Point out that the Anglegs or flexistraws are color coded based on length.
- The students will create different types of triangles using the Anglegs or flexible straws.
- Students will create as many triangles as possible using the anglegs or flexistraws.
- Facilitate a discussion with questions such as:
  - "Did you make any triangles using the same length straws? ", "Did you make any triangles using two of the same color and one different color?"
- List the characteristics the students noted in the group discussion on chart paper.
  - How many different side lengths does it have?
- Through this discussion the students will develop definitions for the following: equilateral triangle, isosceles triangle, and scalene triangle.
- Introduce vocabulary, (equilateral triangle, isosceles triangle, and scalene triangle). See Student Resource 4.
- The students will write the vocabulary in their math notebooks.
- Instruct the students to investigate which combinations of anglegs or straws do not work.
- The students will classify the triangles by angles and sides lengths using geodot paper. The students will group the triangles with a partner. They will share with the class why they grouped them as they did.

Embedded Assessment

With a partner, the students will complete a categorization activity (Frayer Model). See Student Resource 6 and Teacher Resource 7.

Reteaching/Extension

- The lesson will be modified to meet the needs of the special education students by having the vocabulary words pre-typed (See Student Resource 4).
- The teacher will review the vocabulary from lessons 1 and 2 for those students who were unable to complete the Frayer Model organizer. After reviewing the vocabulary, the students will create these triangles using toothpicks or popsicle sticks.
- Extend the lesson for those students who successfully completed the Frayer Model organizer by receiving a score of 2 or 3, on a rubric of 0 – 3. The students will use a ruler to draw triangles with given measurements (See Student Resource 5).

Lesson 3

Pre-Assessment

The students will complete an activity in which they have to circle 3 out of 4 numbers with a sum of 180 (Teacher Resource 8a - b).

Launch

- Create triangles on the overhead/document camera, using pretzel rods.
- The students will copy the model and solve the problems; includes verbal teacher prompts. After each prompt, the teacher will ask questions:
  - "What type of triangle is it?" (equilateral) and "How many do you have?" (See Teacher Resource 9).

Teacher Facilitation/Student Application

- Review the vocabulary words from lessons 1 and 2. (acute triangle, right triangle, obtuse angle and equilateral triangle, isosceles triangle, scalene triangle, right isosceles).
- Display the complete definitions using the document camera or an overhead and transparency.
- Take the students to the computer lab.
- Instruct the students to go to the following website: **http://oneweb.utc.edu/~Christopher-Mawata/geom/geom2.htm**
- Model the triangle activity using a teacher computer with a projection device in the lab.
- The students will use the computer to investigate the sum of angles in a triangle.
- Instruct the students to record angle measurements on the worksheet (See Student Resource 7).
- The teacher will introduce the vocabulary (degree) (See Student Resource 8).

- Lead a discussion on what the students learned from this activity. The students will show that they understand the sum of the angles of a triangle total 180 degrees.
- Return to the pre-assessment and ask the students the question:
  - "If we are given two measurements (e.g. 75 degrees and 25 degrees), could we find the missing angle measurement?"
- The students will find missing angle measurements of triangles using the following website: http://www.321know.com/geo612x5.htm#section2

Embedded Assessment

The students will complete a journal entry in which they are the teacher explaining the sum of the angles of a triangle is always 180 degrees (See Teacher Resource #10a - b).

Reteaching/Extension

- The special education students may use a calculator.
- Review angle measurements with those students whose journal entries received a score of 0 or 1 on a rubric of 0 – 3 (3 is an A and 0 is an E). Show examples of triangles with the angle measurements written in the spaces (See Teacher Resource #11a – b). The students will add up the angle measurements to reinforce the fact that the sum of the angles of a triangle is always 180 degrees.
- Challenge those students whose journal entries received a score of 2 or 3 to find the missing angle in a triangle using a protractor (See Teacher Resource #12a - b).

Summative Assessment:

The summative assessment demonstrates the students' knowledge of triangles. The students should receive a passing grade on the quiz to meet the objectives of the lesson (Teacher Resource 13 a-c.)

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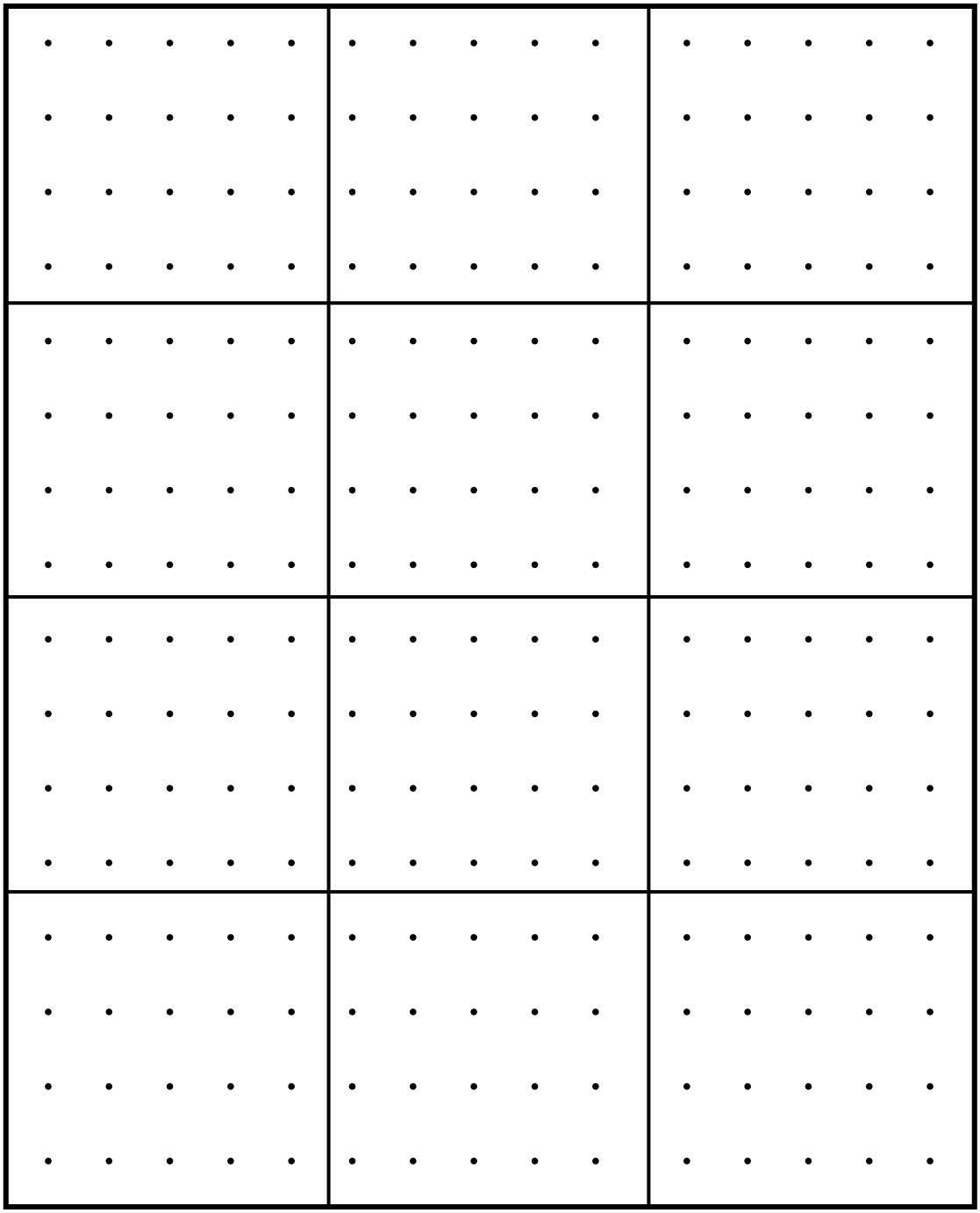
Name _____ Date _____



Classifying Triangles by Angle Measurements
Vocabulary

1. Acute Triangle – a triangle in which each of the three angles is acute (less than 90 degrees)

2. Right Triangle – a triangle with one right angle (exactly 90 degrees)

3. Obtuse Triangle – A triangle that has one obtuse angle (more than 90 degrees)

Independent Enrichment Activity

Materials: rubber band, geoboard, and geodot paper

Directions: Create each polygon using your rubber band and geoboard. Record your polygon creations on the geodot paper.

1. Create a right triangle.
2. Change a right triangle to a square.
3. Change a right triangle to a rectangle.
4. Create an acute triangle.
5. Change the acute triangle to a rhombus.
6. Change the rhombus to an octagon.
7. Create an obtuse triangle.
8. Change the obtuse triangle to a pentagon.

Classifying Triangles by Side Lengths
Vocabulary

1. Equilateral Triangle – a triangle with all sides the same length (congruent)

2. Isosceles Triangle – a triangle with at least two sides of the same length (congruent)

3. Scalene Triangle – a triangle with no sides the same length

Independent Enrichment Activity

Directions: You will need a ruler, a pencil, and a sheet of paper for this activity. Use the following measurements (in inches and centimeters) to draw triangles with the given side length measurements.

1. 7 inches, 7 inches, 7 inches
2. 1 inch, 2 inches, 2 ¼ inches
3. 3 ¾ inches, 4 inches, 5 ¼ inches
4. 1 ½ inches, 6 inches, 6 inches
5. 1 inch, 1 ¼ inches, 2 inches
6. 3 ½ inches, 5 inches, 3 ½ inches
7. ¾ inches, 1 ¼ inches, 1 ¼ inches
8. 2 inches, 3 inches, 3 ½ inches

*Bonus

9. 2 cm, 4 cm, 2 ¼ cm
10. 4 ½ cm, 10 cm, 8 cm

The Frayer Model

Definition **(in your own words)**	**Facts / Characteristics**
Examples	**Nonexamples**

Name: _____ Date: _____

Angle A	Angle B	Angle C	Sum
64°	86°	30°	180°

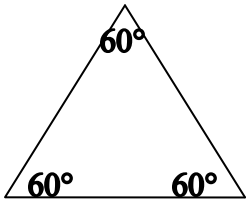
Degrees of a Triangle
Vocabulary

2. Degree – a unit for measuring angles

   *Symbol for degree = °

   *There are 180 degrees in a triangle. (All three angles will total to 180 degrees.)

Example:



Classifying Triangles

Discussion Topics

All triangles have...

Some triangles have...

Triangle Properties

- **All triangles have:**

3 sides
3 angles
180 degrees

- **Some triangles have:**

All acute angles
1 obtuse angle
All sides equal
All angles equal
2 sides equal
2 angles equal
No sides equal

Creating Triangles on the Geoboard

Teacher Prompts:

4. three sides
   one right angle

5. three sides
   two sides equal

6. three sides
   one right angle
   two sides equal

7. a small right triangle

8. a large right triangle

9. a small acute triangle

10. a large acute triangle

11. a small obtuse triangle

12. a large obtuse triangle

* Challenge Tasks

13. How many different sizes of right triangles can you make on the geoboard?

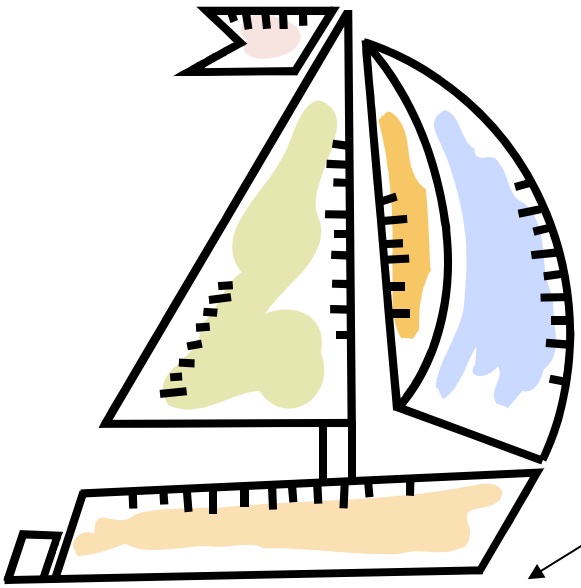
14. Change the right triangle to a rectangle.

15. Change the rectangle to a square.

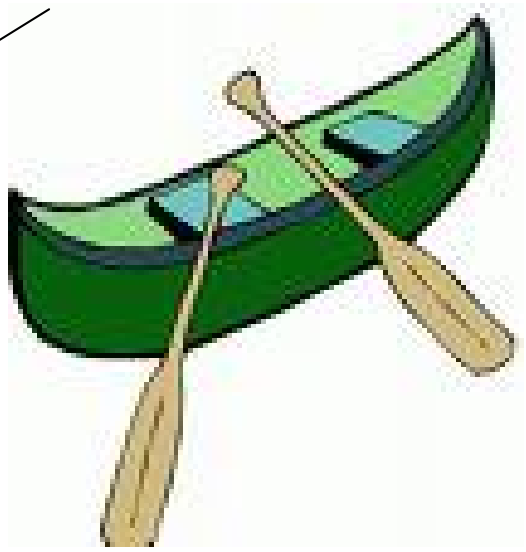
16. Change the square to a trapezoid.

17. Change the trapezoid to a parallelogram.

18. Change the parallelogram to an isosceles triangle.

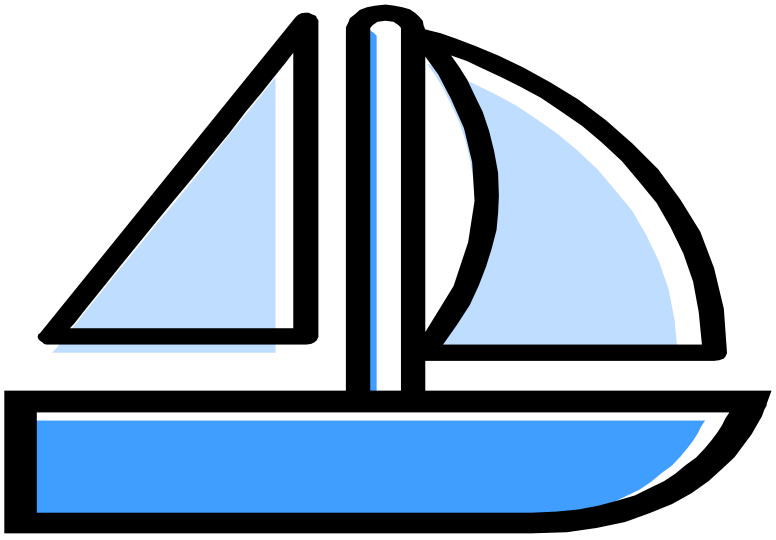


Obtuse angle



Acute angle

Right angle



Exit Ticket

1. Explain the properties of an acute triangle.

_____
_____
_____
_____
_____

2. Draw each of the following types of triangles.

Acute Right Obtuse

Exit Ticket

3. Explain the properties of an acute triangle.

_____
_____
_____
_____
_____

4. Draw each of the following types of triangles.

Acute Right Obtuse

KEY

Acute triangle – all three angles are acute (each one is less than 90 degrees)

Name: _____ Date:_____

If it is a _____, then it has three angles.

If it is a triangle, then it also has ___ sides.

If it is a(n) _____ triangle, then all of its angles are acute.

If it is a right triangle, then one of its angles measures exactly ____ degrees.

If it is a(n) _____ triangle, then it has one obtuse angle.

If it is an equilateral triangle, then it has ___ sides that are the same length.

If it is an isosceles triangle, then it has ___ sides that are the same length.

If it is a scalene triangle, then it has ___ sides that are the same length.

Name: _____

Date:_____

WORD BANK:

Acute	3	0	
Obtuse	2	3	
Triangle	90		

If it is a _____, then it has three angles.

If it is a triangle, then it also has ___ sides.

If it is a(n) _____ triangle, then all of its angles are acute.

If it is a right triangle, then one of its angles measures exactly ____ degrees.

If it is a(n) _____ triangle, then it has one obtuse angle.

If it is an equilateral triangle, then it has ___ sides that are the same length.

If it is an isosceles triangle, then it has ___ sides that are the same length.

If it is a scalene triangle, then it has ___ sides that are the same length.

KEY

If it is a *triangle*, then it has three angles.

If it is a triangle, then it also has *3* sides.

If it is a(n) *acute* triangle, then all of its angles are acute.

If it is a right triangle, then one of its angles measures exactly *90* degrees.

If it is a(n) *obtuse* triangle, then it has one obtuse angle.

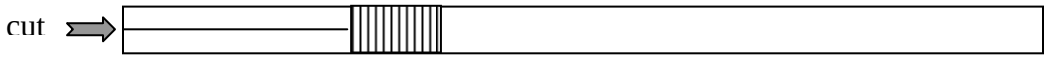
If it is an equilateral triangle, then it has *3* sides that are the same length.

If it is an isosceles triangle, then it has *2* sides that are the same length.

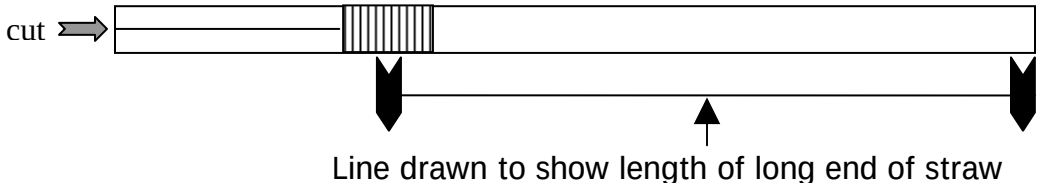
If it is a scalene triangle, then it has *0* sides that are the same length.

Construction of Geometric Flex-Straws
(Different Length Straws)

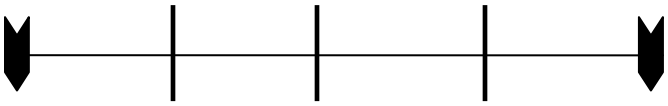
- Purchase 60 flexible drinking straws for each kit you plan to make.
- Slit the drinking straws from the edge to the flexible joint.



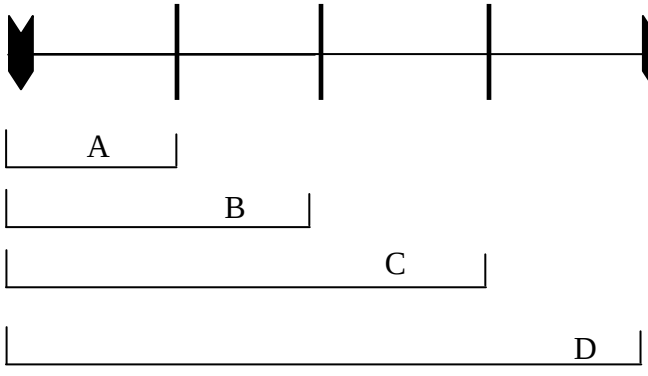
- Place the straw which is bent at the flex joint on a blank piece of paper so that the long end of the straw is touching the paper. Draw a line the length of the straw from the bottom edge of the joint.



- Draw marks on the line to divide it into four lengths.



- Make 15 of each length flex-straw by laying the straw on the line to determine where to cut.



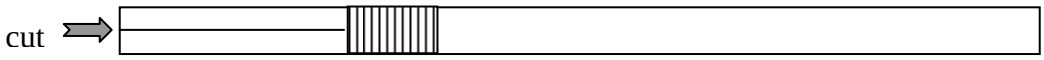
- Place tape on each straw cut to indicate length.
- A=green; B = yellow; C = red; and D = blue
- Place straws in quart-sized Ziploc bag.

Geometric Flex-Straws -1
(Same Length Straws)

To prepare the sets of geometric flex straws that ARE THE SAME LENGTH for your students:

1. Decide if your students will work with the sets of geometric flex straws in pairs or cooperative groups.
2. Purchase enough boxes of flex straws to make a set of 10 straws for each pair or group.
3. Slit the short end of each straw flex (the end you would drink from) from the edge to the flex joint. This allows the short end to be compressed as you fit into the long end of another straw.

Diagram



NOTE: Remind students to ALWAYS put the short slit end into the long uncut end.

4. Place ten of the prepared straws in a gallon-sized plastic bag for each pair of students or cooperative group.

The Frayer Model

Definition **(in your own words)**	**Facts / Characteristics**
A closed plane figure made up of three line segments; three angles with measurements that total 180 degrees	- closed plane figure - 3 line segments - 3 angles (total 180 degrees) - 2-dimensional - Classified by angle measure and/or side length
Examples	**Nonexamples**
Angle: Right triangle (one angle exactly 90 degrees) Acute triangle (less than 90 degrees) Obtuse triangle (more than 90 degrees) Side: Equilateral triangle (all sides equal length) Isosceles triangle (two sides equal length) Scalene triangle (no sides of	Square – 4 sides Pentagon – 5 sides Hexagon – 6 sides Heptagon – 7 sides Octagon – 8 sides Nonagon – 9 sides Decagon – 10 sides

Triangles

Name: _____

Date:_____

Directions: Find the sum of **180** using 3 of the 4 numbers in each set. Please circle or highlight your answers.

Example: 100 75 15 65

---

1. 75 60 25 80

2. 13 62 60 107

3. 99 18 66 15

4. 59 79 43 58

5. 110 24 36 120

6. 60 65 70 55

7. 39 50 91 81

8. 45 65 90 70

Name: _____

Date:_____

Directions: Find the sum of **180** using 3 of the 4 numbers in each set. Please circle or highlight your answers.

Example: 100 75 15 65

---

1. 75 60 25 80

2. 13 62 60 107

3. 99 18 66 15

4. 59 79 43 58

5. 110 24 36 120

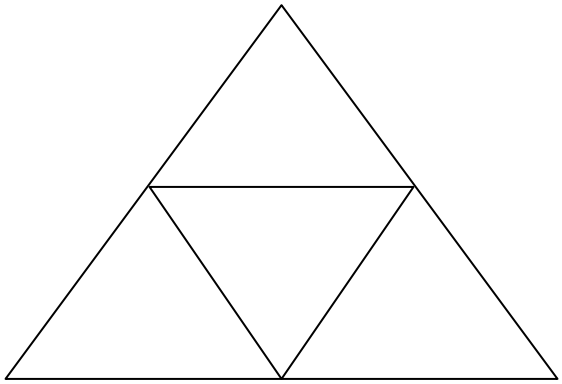
6. 60 65 70 55

7. 39 50 91 81

8. 45 65 90 70

Name: _____ Date: _____

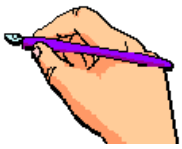
Directions: You have nine pretzel sticks. Make the triangle shape below using your pretzel sticks.



1. Remove two pretzels to get three triangles.
2. Remove two pretzels leaving two triangles.
3. Remove three pretzels leaving one triangle.
4. Remove three pretzels leaving two triangles.
5. Remove six pretzels leaving one triangle.

Name: _____ Date: _____

Journal

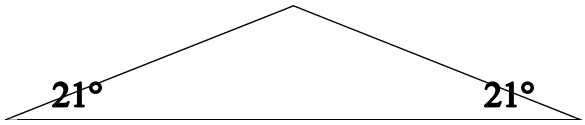


Step A _____

What is the missing angle measure of the triangle below?

Step B

Pretend you are the teacher. Write a journal entry explaining to your students how to find one missing angle measurement of a triangle. Remember to show your work.



KEY

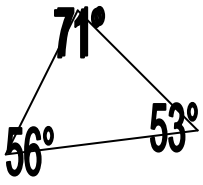
Step A – 138 degrees

Step B – Student responses will vary.

Example: Add the two given angles. Subtract their sum from 180 degrees to get the missing angle measurement.

Name: _____ Date: _____

Directions: Add up the sum of all three angles in each of the triangles.

1. 

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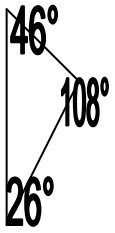
2. 

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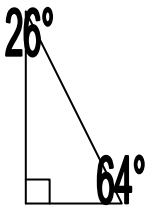
3. 

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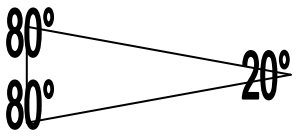
4. 

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_____

KEY

All angle measurements add up to 180 degrees.

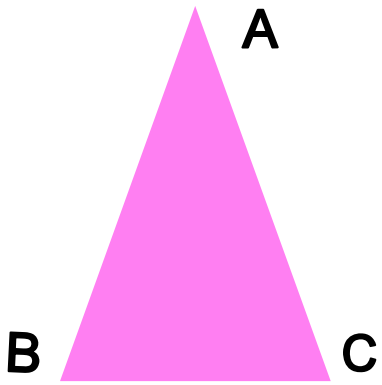
Name: _____ Date: _____

Independent Enrichment Activity

Directions: Use your protractor to measure all three angles in each of the following triangles. Calculate the sum of the angle measurement for each. *(Hint: You may need to extend your lines.)*

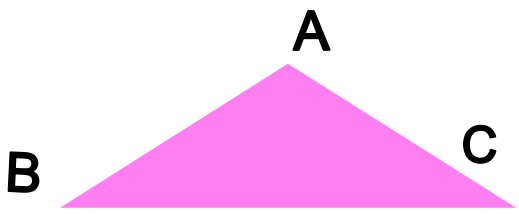
1. A = _____ degrees
   B = _____ degrees
   C = _____ degrees

   ABC = _____ degrees



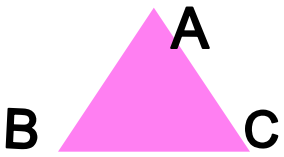
2. A = _____ degrees
   B = _____ degrees
   C = _____ degrees

   ABC = _____ degrees



3. A = _____ degrees
   B = _____ degrees
   C = _____ degrees

   ABC = _____ degrees

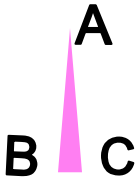


4. A = _____ degrees
   B = _____ degrees
   C = _____ degrees

   ABC = _____ degrees

5. A = _____ degrees
   B = _____ degrees
   C = _____ degrees

   ABC = _____ degrees



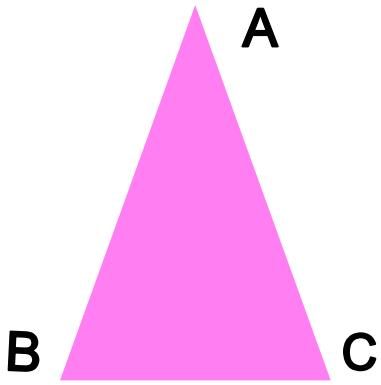
Name: _____ Date: _____

Independent Enrichment Activity

Directions: Use your protractor to measure all three angles in each of the following triangles. Calculate the sum of the angle measurement for each. *(Hint: You may need to extend your lines.)*

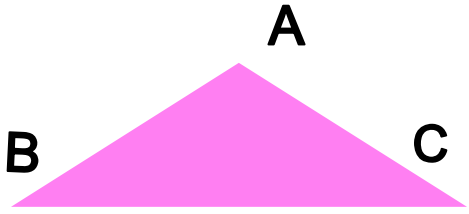
1. A = _40_ degrees
   B = _70_ degrees
   C = _70_ degrees

ABC = 180 degrees



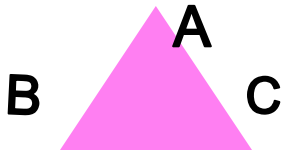
2. A = 115 degrees
   B = _25_ degrees
   C = _30_ degrees

ABC = 180 degrees



3. A = _60_ degrees
   B = _60_ degrees
   C = _60_ degrees

ABC = 180 degrees

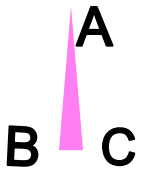


4. A = 160 degrees
   B = _10_ degrees
   C = _10_ degrees

ABC = 180 degrees

5. A = _15_ degrees
   B = _85_ degrees
   C = _80_ degrees

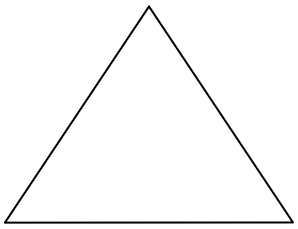
ABC = 180 degree

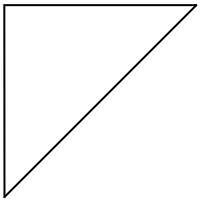


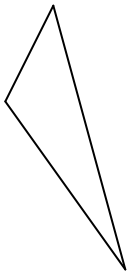
Name: _____ Date: _____-____

Classifying Triangles Quiz

Directions: Classify each triangle in 2 ways (by angle and side).





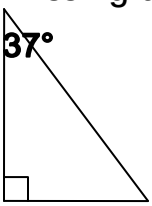


_____ _____ _____

_____ _____ _____

Brief Constructed Response – BCR

Find the missing angle measurement. Explain how you know.



Step A – Missing angle measurement _____ degrees

Directions: Complete the following BCR. Use what you know about triangles to explain why your answer is correct. Use words, numbers, and/or symbols in your explanation.

Step B –

_____

_____

_____

_____

_____

_____
_____

Word Bank for Quiz:

Acute	Equilateral
Right	Scalene
Obtuse	Isosceles

KEY

Equilateral and Acute

Right and Isosceles

Obtuse and Scalene

Missing angle measurement – 153 degrees.
Student written responses will vary.